## Technical Bulletin #1

# GROUNDING

The importance of good wiring practices and **proper grounding** cannot be overemphasized. The PowerUp Customer Service Department routinely encounters field failures (with symptoms of; intermittent or improper functioning, unusual behavior of lights or valves, and even complete failures of equipment to turn on) that consistently are found to be the direct result of poor wiring practices and bad grounding. These types of problems cause much frustration for everyone and yet are unnecessary and completely avoidable if attention is given to basic electrical wiring principles.

Ground is Ground, right? Well yes in theory but not always in practice. Like the closed hydraulic system that electron movement is named after, all the current that leaves the battery needs to return to it. In order for any electrical device to operate reliably in the system it needs more than just a good connection from the battery, but also an equally good return path (Ground) free of resistance back to the battery. Further at the battery this return path needs to be large enough to accommodate all the current used by the many electrical devices on the vehicle.

The term "**Ground**" is often misunderstood in part because the word can be used both as a Verb (an action) and as a Noun (a thing), and because in use the ground is largely an unseen portion of the complete circuit. These mistakes are especially common in the case of single wire electric systems as used in vehicles. So if "Ground" is a common conducting body (such as the truck frame) used as the return path for all electric currents, and it is an arbitrary reference point of zero potential voltage, then "Grounding" is the connecting of an electrical device to such a conducting body. It follows that efficient "Grounding" is only achieved when there is minimal resistance across the entire grounding body forming the return path to the battery. No portion of “Ground” should develop a voltage (as referenced to the battery’s negative) as a result of resistance to the electric currents flowing through it.

Common grounding failures include mistaking a mechanical connection for an electrical connection. Installing a “Ground” to a painted toolbox may fail to provide this needed electrical return path. A “Ground” to a clean welded stud on a toolbox may be very good but the connection from the toolbox to frame might be made only with a few rusty bolts and a small gauge static wire. These kinds of conditions are common and wholly inadequate to provide proper operation of the electrical system. A complete and proper installation involves more than just hooking up the power wires, it requires that the whole circuit be checked for an adequate current path. Careful installation with solid crimped wire connectors and a cleanly dressed wiring harness will minimize potential problems and optimize the performance of all the electrical devices on the vehicle.

U.S. Department of Labor
Occupational Safety & Health Administration (OSHA)

Regulations (Standards - 29 CFR)
PART 1910 - DESIGN SAFETY STANDARDS FOR ELECTRICAL SYSTEMS

1910.399(a)
Definitions –

Ground: The ground is an arbitrarily decided point whose voltage is taken as zero. In many situations, equipment is connected physically to the actual, dirt ground, so that voltage is taken as zero--hence the name. In England the term "earth" is used, for the same reason.

Grounded: To be "grounded" means to be connected to earth or to some conducting body that serves in place of the earth, such that the connection is maintained at "Zero" voltage.

Grounded, Effectively: Permanently connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity that ground fault current which may occur cannot build up to voltages dangerous to personnel or equipment.